REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendments and discussion presented herein.

1. Rejection of Claims 1-11, 21 and 22 under 35 U.S.C. §102(e).

Claims 1-11, 21 and 22 were rejected under 35 U.S.C. §102(e) as being anticipated by Ibaraki et al. (U.S. No. 6,098,733); Claims 1, 9, 21 and 22 are independent.

The Applicant has carefully considered the Examiner's grounds for rejection and has amended Claims 1, 9, 21 and 22 to recite the subject matter of those claims with more particularity. Each of those claims has been amended to recite that the controller is configured to operate the motor simultaneously with said engine and apply positive or negative motor torque to said engine output to maintain engine power output substantially along a predetermined operating line.

It will be appreciated that the engine power is maintained substantially along a predetermined operating line, as now recited in Claims 1, 9, 21 and 22, by the addition and subtraction of torque by the motor coupled to the engine (see specification at page 3, line 11 through page 4, line 5; page 13, lines 11-22). Additionally, although implicit in maintaining the engine power substantially along a predetermined operating line, Claims 1, 9, 21 and 22 were amended to particularly recite that the *motor operates simultaneously with the engine*. In this way, the motor is used to regulate the power output of the engine *while the engine is running*.

Ibaraki et al., however, does not teach these elements of the Applicant's claims. Therefore, Claims 1, 9, 21 and 22, as well as the claims that depend therefrom, are not anticipated by the cited reference.

2. Rejection of Claims 12-15 under 35 U.S.C. §102(e).

Claims 12-15 were rejected under 35 U.S.C. §102(e) as being anticipated by Yamaguchi (U.S. No. 5,806,617); Claim 12 is independent.

In response, the Applicant has amended Claim 12 to recite that the generator controller is configured to operate said generator simultaneously with said engine and apply positive or negative generator torque to said engine output to maintain engine power output substantially along a predetermined operating line. In contrast, Yamaguchi's controller operates a motor or motor/generator in relation to the required acceleration, and does not use a generator (or motor/generator) to alter the torque applied to the engine to maintain a predetermined operating line for the engine (see, col. 8, line 62-67 of Yamaguchi which state that "the value of the motor torque T.sub.M2 is amended to increase so that the driving torque T.sub.O does not decrease when the engine torque decreases, that is, so that the driving torque T.sub.O which should be determined in accordance with the degree the accelerator opens does not vary when the efficiency characteristic of the engine is changed").

Therefore, Claim 12 recites at least one limitation not found in Yamaguchi. Accordingly, Claim 12 and the claims that depend therefrom are not anticipated by the cited reference.

3. Rejection of Claims 12, 16-18 under 35 U.S.C. §103(a).

Claims 12 and 16-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ibaraki et al. in view of Yamaguchi; Claim 12 is independent.

As discussed above, Claim 12 as now amended recites a generator controller which is configured to operate said generator simultaneously with said engine and apply positive or negative generator torque to said engine output to maintain engine power output substantially along a predetermined operating line. Neither Ibaraki et al. nor Yamaguchi teach these elements of Claim 12. Nor does either reference, singly or in combination, suggest or provide motivation or incentive for this aspect of the Applicant's invention.

As explained in the Applicant's specification, a motor or generator is controlled to counteract the negative effect of the $-\dot{R} I_E S_E$ in the dynamic equation

$$\alpha_{DS} = \frac{-\dot{R} I_E S_E - T_E R - T_{loss} - T_{RL}}{I_{DS} + R^2 I_E}, \qquad \dot{R} = \frac{dR}{dt}$$

where α_{DS} = acceleration of the vehicle reflected to the drive shaft, $R = \frac{S_E}{S_{DS}}$, I_E = engine inertia, I_{DS} = vehicle inertia at the drive shaft, S_E =engine speed, S_{DS} = drive shaft speed, T_E = engine torque, T_{loss} = torque losses, and T_{RL} = road load torque at the drive shaft. Because the first term $-\dot{R} I_E S_E$ and the second term $T_E R$ generally oppose each other, the acceleration of the car and the torque and speed of the engine are difficult to control simultaneously. As a result, the best efficiency and minimum emissions for a gasoline or diesel engine cannot be realized without a sacrifice in performance.

The Applicant has overcome this problem by configuring the motor controller to output a positive or negative torque coupled to the engine output so that a predetermined operating line is maintained, such operation at "wide open throttle" (*WOT*), or along the "Ideal Torque/Speed Operating Line" (*IOL*) for best efficiency and lowest emissions, or along any other predetermined operating line. In this way, the engine can be run continuously while energy flows into or out of the battery energy storage system connected to the electric motor/generator. If the battery is large enough to drive the vehicle a long distance, then the efficiency of energy into and out of the battery is high since the battery internal resistance is low.

Because a generator controller having the elements recited in Claim 12 is not taught by either of the cited references, the cited combination does not teach the elements of Claim 12. Furthermore, neither reference suggests or provides motivation or incentive for the invention of Claim 12 or the benefits achieved thereby. It should be understood that operating the engine along a predetermined operating line, such as the IOL, provides the benefit of high efficiency engine operation across a wide speed range for the coupled engine-motor combination, and is not taught or suggested in either reference.

Therefore, the Applicant respectfully submits that Claim 12 is not obvious i view of the cited reference.

4. Rejection of Claims 19 and 20 under 35 U.S.C. §103(a).

Claims 19 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yamaguchi in view of Kawakatsu (U.S. No. 4,407,132); Claims 19 and 20 are

independent.

Referring to the discussion above, Claims 19 and 20 have been amended in a manner similar to Claims 1, 9, 12, 21, and 22. Claim 19 recites that the controller is configured to vary the rate of change of the ratio of said continuously variable transmission and to operate said generator/motor simultaneously with said engine and apply positive or negative generator/motor torque to said engine output to maintain engine power output substantially along a predetermined operating line. Claim 20 recites that the control means is configured to operate said motor simultaneously with said engine to apply positive or negative generator/motor torque to said engine output to maintain engine power output substantially along a predetermined operating line.

As discussed above, Yamaguchi does not teach, suggest or provide motivation or incentive for these elements of the Applicant's claims. Furthermore, Kawakatsu does not describe a controller which modulates the positive and negative torque applied to the engine so that engine operation is constrained to a predetermined operating line, such as IOL, or WOT. This is quite apparent from the text and diagrams of Kawakatsu '132, such as at col. 3, lines 42-51: "only the engine is used as a prime mover of the vehicle if and when the number of revolution and the torque reside in the range of the specific fuel consumption being less than approximately 190 (gr/PS.multidot.h), for example, and only the motor is used as a prime mover or both the motor and the engine are used as a prime mover of the vehicle if and when the torque resides outside the above described range." It will be appreciated that the engine and motor are each often operated separately in response to torque demands. It is apparent that Applicant's invention recited in Claims 19 and 20 utilizes a new principle of operation

which is neither taught nor suggested by the cited combination.

Therefore, the Applicant respectfully submits that Claims 19 and 20, as well as the claims that depend therefrom, are not rendered obvious by the cited references.

5. Conclusion.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

The Applicant also respectfully requests a telephone interview with the Examiner in the event that there are questions regarding this response, or if the next action on the merits is not an allowance of all pending claims.

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Respectfully submitted,

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Invention: **CONTROL METHOD AND APPARATUS FOR INTERNAL COMBUSTION ENGINE ELECTRIC HYBRID VEHICLES**

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